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DECLASSIFIED VERSION OF EXTRACTED PAGES FROM PADUCAH PLANT DEVELOPMENT PROGRESS REPORT FEBRUARY 1975

(DECLASSIFIED VERSION OF EXTRACTED PAGES FROM CRD DOCUMENT #KY-L-765/PT2)

Compiled by
S. G. Thornton
Environmental Management Division
OAK RIDGE K-25 SITE
for the Health Studies Agreement

April 23, 1996

Oak Ridge K-25 Site
Oak Ridge, Tennessee 37831-7314
managed by
LOCKHEED MARTIN ENERGY SYSTEMS, INC.
for the U.S. DEPARTMENT OF ENERGY
under Contract DE-AC05-84OR21400

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PADUCAH PLANT
DEVELOPMENT PROGRESS REPORT
FEBRUARY 1975

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PAD/LSCR-002340

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UNION CARBIDE

PADUCAH GASEOUS DIFFUSION PLANT
PADUCAH, KENTUCKY

prepared for the U.S. ATOMIC ENERGY COMMISSION
under U.S. GOVERNMENT *Contract* W-7405 eng 26

-2-

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PADUCAH PLANT

DEVELOPMENT PROGRESS REPORT

February 1975

UNION CARBIDE CORPORATION
NUCLEAR DIVISION

Paducah Gaseous Diffusion Plant
Paducah, Kentucky

Prepared for the U. S. Energy Research and Development Administration
under U. S. Government Contract W-7405 eng 26

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FALLOUT OF URANIUM DURING UF_6 RELEASES

(T. J. Mayo, Laboratory)

When UF_6 is released to the atmosphere, it is quickly hydrolyzed to UO_2F_2 and HF by atmospheric moisture. Some believe that a large part of the UO_2F_2 rapidly falls to the ground due to gravitational effects while the HF remains airborne. On the other hand, in atmospheric dispersion work it is generally assumed that aerosols (particle diameters less than 20 microns) remain airborne for long periods of time. The gaseous reaction of UF_6 and H_2O frequently produces UO_2F_2 particles of micron or submicron size or, in other words, well down in the aerosol range. There is, therefore, some question about the rapid fallout of UO_2F_2. There is also a possibility that HF, with its strong tendency to adsorb on practically any surface, would attach to the UO_2F_2 particles and also be removed from the air should solids fallout occur.

In this project, the behavior of the UO_2F_2 and HF resulting from the release of gaseous UF_6 to the atmosphere will be investigated.

CURRENT PROGRESS

Since the last report,[1] four additional releases have been made from a five-liter bulb containing known quantities of UF_6 and SF_6. The SF_6 serves as an internal standard and any decrease in the U/SF_6 or F/SF_6 ratio was intended to indicate a loss of uranium or HF from the plume. The UF_6 and SF_6 mixtures were made up so that the weight ratios in the released mixtures were 9.8 for U/SF_6, 4.7 for F/SF_6, with the U/F ratio in UF_6 being 2.1. The results of the four new runs along with the previous runs where samples were obtained at two distances are given in table 1.

All these releases were made in the late afternoon just before dark under clear skies with winds of 5 mph or less. The aim was to release during very stable atmospheric conditions corresponding to a Pasquill F stability category. Observation of the clouds of released material showed that this condition did not always exist and that stabilities actually ranged from stable to neutral or Pasquill categories F to D.

Examination of table 1 shows that while the ratios generally decrease with distance there are cases, runs 7 and 11, where the reverse is true It will also be noted that more often than not the ratios exceed the known release values. Because of such problems, no further work is planned by this method.

There are, however, some worthwhile observations which can be made. Because of the variability of the data, probably the best way to look at it is from the standpoint of overall averages which are summarized in table 2. Considering the ratios in the order presented, the U/F

Table 1

SUMMARY OF UF_6-SF_6 RELEASE RESULTS

Run	Sampling Distance, yards	Ratios U/F	Ratios U/SF_6	Ratios F/SF_6
7	90	2.6	10	3.8
	210	2.1	21	9.9
8	190	2.8	17	6.3
	380	2.3	12	5.2
9	240	2.7	15	4.9
	480	-	10	-
10	70	2.1	29	14
	440	1.6	17	10
11	70	1.5	12	7.9
	440	2.0	11	5.4
12	70	2.1	14	6.5
	440	1.9	9	4.7
Theory		2.1	9.8	4.7

Table 2

SUMMARY OF AVERAGE RESULTS

Sampling Location	U/F	U/SF_6	F/SF_6
Near	2.19	15.9	7.58
Far	1.98	13.3	7.11
% Decrease	9.6	16.4	6.2

ratio change from the near to the far sample point indicates a small loss (9.6%) of uranium relative to the fluoride. The fluoride here is defined as the fluoride in the UO_2F_2 plus HF from the hydrolysis. A similar loss of uranium (16.4%) is indicated by comparison to the internal standard SF_6. Only a minor loss (6.2%) of fluoride is indicated. At best, these values can only be considered as semiquantitative estimates because of the obviously poor precision of the data. It is concluded that some loss of uranium does occur downwind from an outside release during relatively stable weather conditions. The extent of the loss is not well defined, but it is probably small and almost certainly does not exceed 20-25% in a quarter of a mile.

During three of the releases, run 7 in table 1 and runs 4 and 6 reported previously, the clouds produced by the 160-gram UF_6 releases were visible for at least a half mile. The atmosphere was very stable, and the clouds stayed near the ground permitting the extended observation. Neither this nor observations in the vicinity of the release points suggest a large loss of material. These observations appear to support the previous conclusion that it cannot be assumed a large portion of the uranium will quickly fall out of the cloud.

Two additional determinations were made concerning HF adsorbed on UO_2F_2 or other atmospheric particles. This was done by placing an uncoated filter in front of the K_2CO_3-coated filters in the sampling heads. In a total of five determinations from 36 to 50 percent of the total fluoride was found on the uncoated filter. The average value was 43 percent. Since 33 percent of the fluoride would be present as UO_2F_2, this indicates that about 15 percent of the remaining fluoride, presumably as HF, was adsorbed on material trapped by the first filter. It is thus indicated that 85 percent of the HF was not adsorbed.

REFERENCE

[1] Mayo, T. J., *Paducah Plant Development Progress Report, November 1974*, KY-L-694-11, January 6, 1975.

DISTRIBUTION

1. K-25 Site Records (RC)
2. ChemRisk/Shonka Research Associates
3. DOE Public Reading Room
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